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Current Surgical Management of Splenic Cysts: A Narrative Review With Institutional Experience in Laparoscopic Unroofing

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ABSTRACT

Splenic cysts are rare clinical entities, frequently identified as incidental findings during radiologic investigations for unrelated abdominal complaints. Although often asymptomatic, large cysts can become clinically significant due to mass effect, rupture, or secondary infection. Surgical management of splenic cysts has evolved significantly, with a paradigm shift from total splenectomy to spleen-preserving strategies including partial splenectomy and minimally invasive techniques such as laparoscopic unroofing. This article presents a comprehensive narrative review of current approaches to splenic cyst management, integrating institutional experience with a detailed literature synthesis. We discuss classifications, indications for surgery, technical aspects of various procedures, clinical outcomes, recurrence risks, and perioperative considerations. A case from our institution involving successful laparoscopic unroofing of a giant splenic cyst in a young female patient is presented to contextualize the evidence-based discussion.

Keywords: Splenic Cyst, Laparoscopic Deroofing, Spleen Preservation, Partial Splenectomy, Minimally Invasive Surgery, Postoperative Outcomes

INTRODUCTION

Splenic cysts are infrequent lesions representing a diagnostic and therapeutic challenge for surgeons. Their incidence in clinical practice is low, with studies citing an occurrence rate of less than 0.5% in splenic pathologies based on autopsy series [1]. These cysts are broadly classified as primary (true) or secondary (false), with true cysts comprising congenital and parasitic etiologies, while false cysts typically arise post-trauma [2]. The widespread use of advanced imaging modalities has led to increased incidental detection of asymptomatic splenic cysts, shifting the focus toward individualized, less invasive treatment options.

Historically, total splenectomy was considered the definitive management, especially for large or symptomatic cysts. However, increased awareness of the spleen's immunological role and the risk of overwhelming post-splenectomy infection (OPSI) has led to greater emphasis on spleen-conserving procedures [3]. Laparoscopic techniques, particularly unroofing or deroofing, have gained popularity due to reduced morbidity, faster recovery, and preservation of splenic function [4].

Classification And Pathogenesis

Splenic cysts are classified as:

- **Primary (true) cysts**: Lined by epithelial or endothelial cells, these include congenital (epidermoid, mesothelial) and parasitic (notably hydatid disease caused by *Echinococcusgranulosus*) cysts [5].
- **Secondary (false) cysts**: These lack epithelial lining and are most commonly post-traumatic, resulting from intrasplenic hematoma organization [6].

True cysts are more common in children and young adults, while pseudocysts often appear after blunt abdominal trauma. Pathogenesis involves either mesothelial invagination, failure of mesothelial fusion, or vascular malformations [7].

Surgical Techniques

3.1 Total Splenectomy Total splenectomy ensures complete resolution and eliminates recurrence risk but results in permanent immunocompromise. It is generally reserved for complex cysts involving the hilum, suspected malignancies, or when other methods are contraindicated [9]. A meta-analysis by Akhmedov et al. (2020) showed postoperative infection rates as high as 9.7% in splenectomized patients, reinforcing the need for vaccination and long-term prophylaxis [10].

3.2 Partial Splenectomy Partial resection preserves immunologic function and is suitable for peripheral cysts. However, it carries a higher risk of bleeding and requires precise anatomical knowledge and vascular control. Data from a prospective cohort by Colombo et al. (2018) demonstrated comparable outcomes with significantly reduced risk of OPSI compared to total splenectomy [11].

3.3 Laparoscopic Unroofing (Deroofing) Unroofing entails excision of the cyst's anterior wall with marsupialization into the peritoneal cavity. It offers advantages of minimal invasiveness, short hospital stay, and preservation of splenic tissue [12]. Rasheed et al. (2021) reviewed 34 cases and found a recurrence rate of 14.7%, with most recurrences occurring within 18 months [13].

Laparoscopic unroofing is contraindicated in cysts suspected of malignancy or with deep parenchymal invasion. Preoperative imaging and intraoperative assessment are vital to confirm eligibility.

Comparative Outcomes

Technique	Hospital Stay (days)	Recurrence Rate	Infection Risk	Spleen Function
Total Splenectomy	4–7	0%	High	Absent
Partial Splenectomy	3–5	<5%	Moderate	Preserved
Laparoscopic Unroofing	1–3	~15%	Low	Preserved

Yuan et al. (2023) reported that laparoscopic unroofing resulted in the shortest operative time and length of stay compared to other approaches in a systematic review of 186 patients [14].

Epidemiology
The true incidence of splenic cysts is estimated at 0.07%–0.3% based on autopsy data[16]. They are more frequent in children and young adults. Congenital cysts are more common in females, while pseudocystsaffect both sexes equally. Hydatid cysts are rare in developed countries but remain endemic in parts of Latin America, the Middle East, and Africa[17]. Increased use of imaging has led to more incidental findings of asymptomatic cysts[18].

Clinical Presentation
Small cysts are often asymptomatic. Larger cysts may cause left upper quadrant pain, early satiety, nausea, vomiting, or a palpable mass[19]. Complications include rupture (which may cause peritonitis), hemorrhage, infection, and compression of adjacent structures[20]. Kehr's sign (left shoulder pain) may indicate diaphragmatic irritation[21]. Physical exam may reveal splenomegaly or a non-tender mass. Laboratory findings are often non-contributory[22].

Diagnostic Evaluation
Ultrasound is the first-line modality, showing anechoic lesions with posterior enhancement[23]. CT and MRI help assess cyst characteristics, location, wall thickness, septations, and relationships to nearby organs[24]. Serological tests are crucial when parasitic origin is suspected[25]. Differential diagnoses include pancreatic pseudocysts, renal cysts, mesenteric cysts, and neoplastic lesions[26]. Fine-needle aspiration is generally avoided due to risk of hemorrhage or infection[27].

Case Report – Institutional Experience
A 24-year-old woman presented to the outpatient clinic with nonspecific gastrointestinal discomfort. As part of the diagnostic workup, an abdominal ultrasound was performed, revealing an anechoic, well-defined lesion located in the splenic region. For better characterization, a contrast-enhanced abdominal CT scan was obtained, showing a single cystic formation measuring approximately 20 × 15 cm, situated on the anterior surface of the spleen. The lesion had thin walls, no septations, no solid components, and no calcifications. There was no involvement of adjacent organs, nor signs of rupture or hemorrhage. The patient had no history of trauma or infection, and baseline laboratory tests showed no significant abnormalities.

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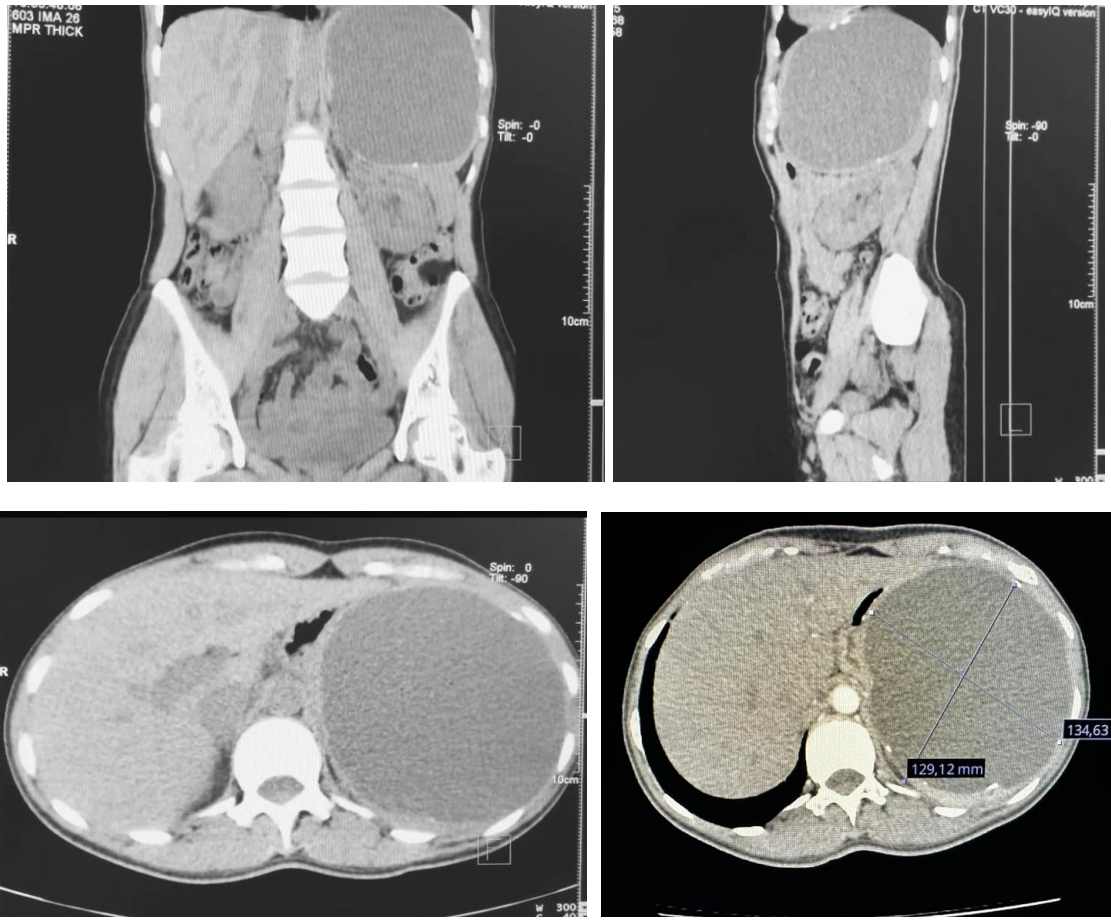
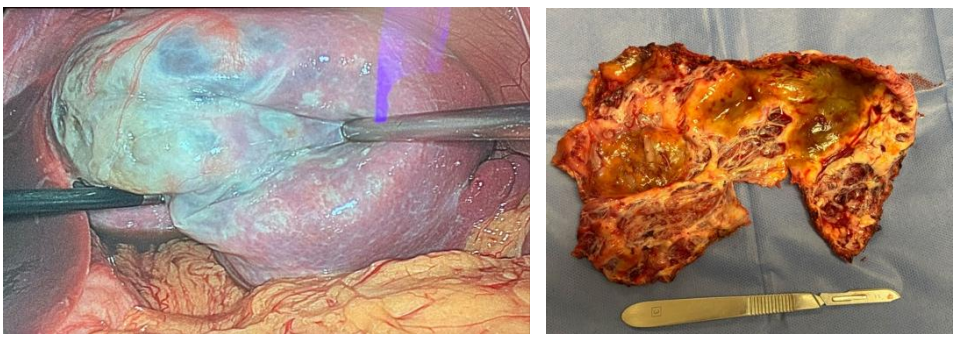


Given the presence of a giant splenic cyst with potential risk for complications such as spontaneous rupture, infection, compression of adjacent organs, and persistent symptoms, elective surgical intervention via laparoscopic approach was indicated.

The procedure was performed under general anesthesia in March 2025. The patient was positioned supine, and antibiotic prophylaxis was administered. Four laparoscopic ports were placed: a 10 mm umbilical port for the camera, a 10 mm subxiphoid auxiliary port, and two 5 mm ports in the left flank and epigastrium. Upon laparoscopic exploration, a large, thin-walled cyst (approximately 0.4 mm thick) was identified on the anterior surface of the spleen. It contained clear, serous fluid and was well demarcated from the surrounding splenic parenchyma, without adhesions or signs of inflammation.

Laparoscopic unroofing was performed using an ultrasonic energy device, with controlled evacuation of approximately 1400 cc of serous fluid. The fluid was collected and sent for microbiological culture, which showed no bacterial growth. Approximately 19 × 13 cm of the cyst wall was resected, preserving the functional splenic tissue. Hemostasis was confirmed, and a Penrose drain was placed in the surgical bed and exteriorized through the lower accessory port.



The procedure was uneventful, with an estimated blood loss of 30 cc. The patient was transferred to the post-anesthesia care unit and then to the surgical ward, where she had an adequate recovery: tolerated oral intake within 24 hours, had good pain control with non-opioid analgesics, and showed no signs of systemic inflammation. She was discharged on postoperative day two in stable condition, with instructions for outpatient follow-up.

At subsequent follow-up visits, the patient remained asymptomatic, with no pain, fever, or signs of complication. As of the last clinical review, her postoperative course has been satisfactory and complication-free.

Immunologic And Long-Term Considerations

The spleen plays a crucial role in immune defense against encapsulated organisms[28]. Splenectomy increases risk for sepsis and mandates vaccination against *Streptococcus pneumoniae*, *Haemophilusinfluenzae*, and *Neisseria meningitides[29]*. Antibiotic prophylaxis is also recommended[30]. Partial splenectomy and unroofing maintain splenic function and reduce long-term infection risk[31]. Patients should be educated about seeking early care for febrile illnesses[32].

Cost-Effectiveness And Healthcare Burden

Laparoscopic procedures reduce hospitalization costs and recovery time[33]. In resource-limited settings, unroofing is cost-effective for benign cysts[34]. Although robotic surgery offers precision, its cost limits widespread use[35]. In contrast, partial splenectomy may require longer operative time and more resources[36]. Colombo et al. (2018) reported that laparoscopic unroofing had the lowest overall cost per quality-adjusted life year (QALY)[37].

Limitations And Future Directions

Due to the rarity of splenic cysts, most data come from case series and retrospective studies[38]. Long-term recurrence data are limited. There is a need for multicenter prospective studies and consensus guidelines[39,40]. Advances in imaging, laparoscopic instrumentation, and robotic techniques may further improve outcomes. Establishing regional registries could enhance epidemiological tracking and decision-making.

DISCUSSION

The management of splenic cysts must balance definitive treatment with functional preservation. In our institutional experience, laparoscopic unroofing for benign, superficial cysts offers an excellent balance of safety, efficacy, and patient recovery. Key factors for success include preoperative imaging, surgical expertise, and postoperative monitoring.

While the recurrence rate is slightly higher with unroofing compared to splenectomy, the benefits of preserving splenic function and avoiding long-term immunological consequences are substantial [15]. Patient selection remains critical; any suspicion of parasitic or neoplastic pathology warrants alternative approaches.

CONCLUSION

Splenic cysts are uncommon but clinically significant lesions. Accurate diagnosis and individualized management are essential. While total splenectomy remains an option for select cases, spleen-preserving techniques like laparoscopic unroofing are increasingly preferred due to their favorable risk profiles and preservation of immune function. In experienced hands, laparoscopic unroofing offers an excellent balance between efficacy and safety.

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